

An optical processor for controlling a phased antenna array uses a frequency-shifted feedback cavity (FSFC), which includes a traveling-wave cavity. The FSFC incrementally delays and incrementally frequency shifts optical signals circulating in the traveling-wave cavity. Optical signals coupled out of the FSFC are separated by frequency, hence by delay, and processed to control either or both transmit and receive beam-forming operations. The FSFC provides a receiver with multiple receive signals which have incremental values of frequency. Each frequency corresponds to an incremental time sampling of optical signals input into the FSFC. Transmit signals coupled out of the FSFC have frequency and phase relationships that result in short time-domain pulses when combined. Controlling modulation and frequency of the transmit signals achieves carrier interference multiple access, a new type of spread-spectrum communications.